On page 5, in paragraph 2 of the Office Action, claims 1-4 and 7/1-7/4 are rejected under 35 U.S.C. §103(a) as being unpatentable over Nishiyama et al., U.S. Patent No. 6,300,700 in further view of Oishi, Japanese Patent Application 403207256. This rejection is respectfully traversed.

Nishiyama mentions a motor as detailed in the description of the related art section. As noted by the Examiner, Nishiyama neither teaches nor suggests "where at least a part of an outer periphery of one pole of the rotor, in a cross section perpendicular to a central axis of the rotor, is defined by a curve of a hyperbolic function" as recited in claim 1.

Oishi describes forming a permanent magnet 13 in two parallel circular arc, two parallel elliptical arc or two parallel hyperbola as part of an armature facing a field iron core 10, to move the field iron core 10 in a longitudinal direction. However, Applicants are not contending that hyperbolas are unknown. Applicants contend that "an outer periphery of one pole of the rotor, in a cross section perpendicular to a central axis of the rotor, is defined by a curve of a hyperbolic function" is neither taught nor suggested. Oishi mentions using permanent magnets defined by two parallel hyperbolas in a linear fashion as part of a stator.

The present claims recite that at least a part of an outer periphery of one pole of the rotor in a cross section perpendicular to a central axis of the rotor is defined by a curve of a hyperbolic function. The hyperbolic function and a hyperbola are completely different in definition. A hyperbolic function is expressed as a relationship between the distance from a point on a hyperbola to the origin as a function of an angle and defines a point in terms of the coordinate axis, an example of which is expressed by the following equation: $Y=(e^{x}+e^{-x})/2$.

Contrary to the above, a linear hyperbola is defined by a set of points in a plane whose distances to two fixed points in a plane have a constant difference, as expressed by the equation $Y=\pm b/a\sqrt{X^2-a^2}$. The teachings of Oishi mention that a longitudinal cross section of a permanent magnet is defined in part by two parallel circular arcs, two parallel elliptical arcs and two parallel hyperbolas. The circular arcs, elliptical arcs and hyperbolas are all conic sections, which are curves, formed by the intersection of a plane with a right circular cone.

Thus, Oishi fails to address the difficulties of a curved motion as opposed to linear, the advantages of an outer, peripheral surface defined by a parabolic function or the difficulties of a circular apparatus that will pass a given location a number of times. Therefore it is not obvious to combine a curve of a hyperbolic function from the disclosure in the Oishi reference. Thus, Oishi neither teaches nor suggests that hyperbolic shaped magnets can be used in a "circular

rotor for a synchronous motor" as recited in claim 1.

In addition, as noted by the Examiner, Nishiyama fails to teach "that the at least the outer periphery of one pole of the rotor is defined by the curve of a hyperbolic function." The Examiner relies on Oishi for the teaching of permanent magnet 13 defined by two parallel hyperbolas. However, as stated in MPEP 2143.01 (quoting In Re Fine) "Obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching suggestion, or motivation to do so found in either the references themselves or the knowledge generally available to one of ordinary skill in the art." There is no suggestion in either Nishiyama or Oishi to combine the two references.

Therefore, one assumes that the Examiner is relying on the knowledge generally available to one of ordinary skill in the art. The knowledge of one of ordinary skill in the art would not lead to a combination of a circular motor with linear thrust generator absent the hindsight provided by the applicants' application. The Examiner's statement that "it would be obvious at the time the invention was made to one having ordinary skill in the art to modify Nishiyama et al.'s invention to determine the curved surface of the rotor by hyperbolas for a constant thrust" does not comply with MPEP 2141.01 (a) which states (quoting In re Oetiker) "the reference must either be in the field of the applicants endeavor or, if not, then be reasonably pertinent to the particular problem with which the inventor was concerned." The Oishi reference is not in the field of the applicants endeavor, as it is directed toward having curves on a separate portion of the device, and the device produces a different type of motion.

Dependent claims 2-4 are allowable as depending on independent claim 1, as well as for the additional features recited therein. Claim 7 is additionally patentable as reciting a train of points on the curve of a hyperbolic function, which is non obvious from the hyperbola discussed by Oishi as discussed above. Reconsideration and withdrawal of the rejection of claims 1-4 and 7/1-7/4 is respectfully requested.

Claims 8-14 are allowable for reasons similar to those discussed above in relation to claim 1, i.e. claim 8 recites "a circular rotor with a plurality of magnetic poles perpendicular to a central axis of the rotor, wherein at least one magnetic pole of the plurality of magnetic poles has an outer edge that is defined by a curve of a hyperbolic function." Prompt consideration and allowance of claims 8-14 is respectfully requested.

On page 6, in paragraph 4 of the Office Action, claims 5, 6, and 7/5 and 7/6 are rejected under 35 U.S.C. §103 as being unpatentable over Nishiyama et al., U.S. Patent No. 6,300,700

in further view of Oishi, Japanese Patent Application 403207256, in further view of the Examiners statement that it would have been obvious to one of ordinary skill in the art. The rejection is respectfully traversed.

The Examiner has not provided prior art support for his rejection by the statement it would be obvious to one of ordinary skill in the art, which is basing the rejection in part on the personal knowledge of the Examiner. The personal knowledge of the Examiner when used as a basis for a rejection is to be supported by an affidavit as to the specifics of the facts of that knowledge when called for by applicant. See, e.g. 37 C.F.R. § 1.104(d)(2). In short, the rules of the U.S. Patent and Trademark Office do not allow discretion on the part of the Examiner for presentation of only his statement. Accordingly, it is requested the Examiner support this assertion with an Affidavit for further consideration by Applicants or withdraw this rejection. It is submitted that claims 5, 6, and 7/5 and 7/6 are allowable as depending on claim 1, as well as for the additional features recited therein.

There being no further outstanding objections or rejections, it is submitted that the application is in condition for allowance. An early action to that effect is courteously solicited.

Finally, if there are any formal matters remaining after this response, the Examiner is requested to telephone the undersigned to attend to these matters.

If there are any additional fees associated with filing of this Amendment, please charge the same to our Deposit Account No. 19-3935.

Respectfully submitted,

STAAS & HALSEY LLP

Date: 30 Apr 02

By: Heath E. Wells

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE TITLE:

Please REPLACE the Title with the following: HYPERBOLIC EXTERIOR SHAPE FOR A ROTOR IN A SYNCHRONOUS MOTOR (AS AMENDED)

IN THE SPECIFICATION:

Please amend the specification Page 5, Paragraphs 3-4 in accordance with the following:

FIG. 3 shows a cross section of a rotor of a synchronous motor on a plane perpendicular to an axis of a rotor shaft 2 according to a third embodiment. Magnets [3]1 each having an outer periphery defined by a curve of a hyperbolic function are fixed on an outer surface of the rotor core 3.

FIG. 4 shows a cross section of a rotor of a synchronous motor on a plane perpendicular to an axis of a rotor shaft 2 according to a fourth embodiment. In this embodiment, magnets [3]1 are arranged radially in the rotor core 3. An outer periphery F of each pole L of the rotor is defined by a curve of a hyperbolic function.

IN THE DRAWINGS:

Please amend the Drawings in accordance with the enclosed Letter to the Examiner Requesting Approval of Changes to the Drawings.

IN THE CLAIMS:

Please AMEND claims 1-7 as follows:

1. (ONCE AMENDED) A circular rotor for a synchronous motor, comprising:
a plurality of poles, where at least a part of an outer periphery of one pole of the rotor, in a cross section perpendicular to a central axis of the rotor, [being] is defined by a curve of a hyperbolic function.

2. (ONCE AMENDED) A circular rotor for a synchronous motor according to claim 1, wherein [the most part] more than half of the outer periphery of the one pole of the rotor is defined by [the curve of] the hyperbolic function.

3. (ONCE AMENDED) A circular rotor for a synchronous motor according to claim 1, wherein [the whole part] all of the outer periphery of the one pole of the rotor is defined by the [curve of the] hyperbolic function.

4. (ONCE AMENDED) A circular rotor for a synchronous motor according to claim 1, wherein a central part of the outer periphery of the one pole is defined [the curve of] the hyperbolic function.

5. (ONCE AMENDED) A circular rotor for a synchronous motor according to claim 1, wherein [said] the hyperbolic function is expressed as $R = A-B * (e^{c\theta} + e^{-c\theta})$, where R represents a distance from a central axis of the rotor or a fixed point, θ represents a rotational angle from a straight line passing through a center of the outer periphery of one pole and perpendicular to the central axis of the rotor, A, B and C are constants and e is a base of natural logarithm or a constant.

6. (ONCE AMENDED) A circular rotor for a synchronous motor according to claim 1, wherein [said] the hyperbolic function is expressed as $X = A-B * (e^{cY} + e^{-cY})$ on a X-Y coordinate system with a X axis passing through a center of the outer periphery of one pole of the rotor and perpendicular to a central axis of the rotor, a Y axis perpendicular to the X axis and the central axis of the rotor and an origin as a crossing point of the X axis and the Y axis, where A, B and C are constants and e is a base of natural logarithm or a constant.

7. (ONCE AMENDED) A rotor for a synchronous motor according to claims 1 through 6, wherein the outer periphery of one pole of the rotor includes a region defined based on the hyperbolic function and a second region [is] defined based on segments of straight lines or curves.

Please ADD the following claims:

8. (NEW) A synchronous motor, comprising:

a circular rotor with a plurality of magnetic poles perpendicular to a central axis of the rotor, wherein at least one magnetic pole of the plurality of magnetic poles has an outer edge that is defined by a curve of a hyperbolic function.

9. (NEW) A synchronous motor according to claim 8, wherein more than half of the outer periphery of the one pole of the rotor is defined by the hyperbolic function.

10. (NEW) A synchronous motor according to claim 8, wherein all of the outer periphery of the one pole of the rotor is defined by the hyperbolic function.

11. (NEW) A synchronous motor according to claim 8, wherein a central part of the outer periphery of the one pole is defined the hyperbolic function.

12. (NEW) A synchronous motor according to claim 8, wherein the hyperbolic function is expressed as $R = A\text{-}B * (e^{c\theta} + e^{-c\theta})$, where R represents a distance from a central axis of the rotor or a fixed point, θ represents a rotational angle from a straight line passing through a center of the outer periphery of one pole and perpendicular to the central axis of the rotor, A, B and C are constants and e is a base of natural logarithm or a constant.

13. (NEW) A synchronous motor according to claim 8, wherein the hyperbolic function is expressed as $X = A\text{-}B * (e^{cY} + e^{-cY})$ on a X-Y coordinate system with a X axis passing through a center of the outer periphery of one pole of the rotor and perpendicular to a central axis of the rotor, a Y axis perpendicular to the X axis and the central axis of the rotor and an origin as a crossing point of the X axis and the Y axis, where A, B and C are constants and e is a base of natural logarithm or a constant.

14. (NEW) A synchronous motor according to claim 8, wherein the outer periphery of one pole of the rotor includes a region defined based on the hyperbolic function and a second region is defined based on segments of straight lines or curves.